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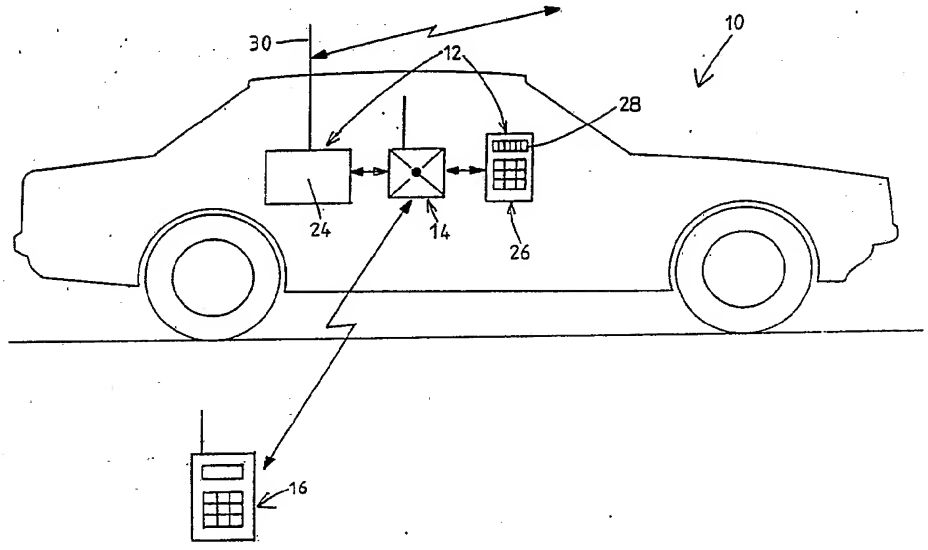

(57) Abstract

Radio telephone equipment comprises three transceivers (14, 16, 24) arranged such that radio communication between an antenna of a telephone network, and a portable, low-power handset incorporating one of the three transceivers (16), takes place over two radio communication links, the two links being interfaced by the other two of the three transceivers (14, 24). Interference is reduced because the second communication link, to the transceiver (16) of the handset, can be based on radio frequencies substantially different from those selected for the first communication link between said antenna and the interfacing transceivers (14, 24). Further, the second communication link can be established in a manner independent of the nature of the first communication link. No fixed data link is necessarily required in addition to voice communication transceiving equipment. The radio telephone equipment finds particular application in cellular radio telephone systems.

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"COMMUNICATIONS APPARATUS"

This invention relates to communications apparatus, such as radio telephones.

Radio telephones of the kind usually installed in motor vehicles generally comprise a suitable transceiver, having a radio receiver and transmitter, suitable transducers, such as microphones and loudspeakers, for transcribing received radio signals to sound signals and for transcribing sound signals, such as a user's voice, to radio signals, the transcribed signals being transmitted and received by the transducers as necessary to effect communication by radio, for instance via a cellular radio system, to other telephones. To avoid interference problems, voice communication is generally limited to an assigned frequency range. In a cellular system, this range may comprise a number of frequency channels, selected

in each case by the cellular radio system from a range of channel frequencies made available to it by, for instance, a relevant authority. Generally, too, there will be provided some form of control means in the radio telephone, such as a dialling device.

Commonly, radio telephones of the above kind are fixed installations in a vehicle and cannot be moved therefrom. However, in recent times there have appeared on the market portable radio telephones. These can be moved in their entirety from the vehicle when necessary, so as to be usable as a separate unit away from the vehicle. Although such units have considerable advantage over fixed installations, they tend to be expensive and may not possess the ability to be used for long periods without recharging of the internal batteries, or may suffer other deficiencies such as insufficient transmission power due to the need to reduce the devices to a small size for the sake of portability.

Further, since each portable radio telephone must be capable of transmitting over a minimum distance, there is an increased risk of interference between neighbouring portable radio telephones, particularly for instance in areas of congested vehicle traffic.

In US patent No. 4659878, there is described a cellular radio telephone system wherein there is an extra transmission link between a telephone network and a portable handset, there being provided an intermediate unit having transceiving means. The extra link is designed to reduce the problem of interference by modifying the cellular frequency channel assigned to a particular portable handset by the cellular system for voice communication, by means

of incorporating a channel offset in the transmission link to the handset, of for instance one channel. There is also described, in the intermediate unit, separate means to provide a data link with the portable handset, which data link then establishes a separate voice communication channel, offset as above-described.

An object of the invention is to provide an improved radio communications apparatus.

In one aspect, the invention provides a communications apparatus comprising first and second transceiver means, each for receipt and transmission, by radio transmission, of information signals, such as voice signals, the first transceiver means being provided with coupling means for coupling it to a further transceiver means whereby signals received by the first transceiver means from the second transceiver means are directed to a further transceiver means for transmission by radio transmission therefrom and whereby signals received by the further transceiver means are directed to the first transceiver means for transmission by radio transmission to the second transceiver means.

The aforementioned coupling means may be in the form of a suitable relay or switch unit. Where the further transceiver means comprises a transceiver connected to a handset which handset includes at least a microphone, and possibly a loud speaker as well, and such interconnection is provided by a flexible line, the coupling means may comprise means for coupling the first transceiver into said line.

Generally speaking, the second transceiver means will be mobile, having its own electric power source, such as rechargeable batteries. The first

transceiver means may then be of a type which is arranged to be physically connected with the further transceiver means. Thus, the coupling means may be switchable to a condition where the handset may be used normally with the further transceiver means and to a condition where the handset is decoupled from the transceiver of the further transceiver means for control of the transceiver from the first transceiver means.

Where an embodiment of the invention is used in association with a cellular radio system and the further transceiver means communicates with the cellular radio system via an assigned cellular frequency channel, it is preferable that the first transceiver means be adapted for voice communication with the second transceiver means via a communication link which is selected by the first and/or second transceiver means and is entirely independent of the assigned cellular frequency channel. In such an arrangement, it may be desirable that the communication link should be based on a carrier frequency which is excluded from the available range of assignable cellular frequency channels. This may be particularly desirable where the communication link otherwise relies on a similar modulation regime to that of the associated cellular radio network.

It is advantageous that the first and second transceiver means be capable of establishing a communication link which is independent of the cellular radio system since this provides flexibility in the radio system that embodiments of the invention can be used in association with. That is, communications apparatus according to the present invention need not be dedicated to use with a single

radio system, or type of radio system.

It is not necessary in embodiments of the present invention that there should be provided means to establish a fixed data link between the first and second transceiver means, or a data link which is separate from the means provided to establish the communication link referred to above. Although a preliminary data link will generally be used to establish the communication link, it may be provided by the same equipment which is operative in the communication link.

It may also be noted that embodiments of the invention only require a minimum number of antennae, for instance, one external antenna per transceiver.

In a particularly versatile embodiment of the invention, there is provided a radio telephone for use in association with a vehicle, comprising a primary transceiver for communication with a telephone network, and a primary handset, said primary transceiver and handset being for installation in the vehicle, the primary handset being coupled to the primary transceiver for control thereof, and further comprising an additional transceiver for installation in the vehicle, and a portable handset having an integral transceiver, the portable handset being adapted for radio communication by means of its integral transceiver with the additional transceiver in the vehicle, the additional transceiver being coupled to the primary transceiver such that communication with the telephone network via the primary transceiver can occur under the control of either the primary or the portable handset.

Equipment according to this latter

embodiment of the present invention has the advantage that communication via the telephone network can be carried out either via a physical connection which avoids interference between neighbouring sets of equipment, or where necessary via a portable handset. Overall, however, the risk of interference is reduced even where using a portable handset since interference will only occur where a neighbouring set of equipment is also being operated using the portable handset. This is unlikely to be the case for instance in congested traffic conditions where the physically connected link will be available.

In any embodiment of the present invention, a portable handset which only has to be provided with sufficient power to transmit signals to a local, associated transceiver, and not to a transceiver of the public or a cellular telephone network, can be used. Such a handset requires less power than one which communicates directly with a transceiver of a public cellular telephone network, which aids portability.

The invention is further described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a diagram of a vehicle fitted with a communications apparatus constructed in accordance with the invention;

Figure 2 is a diagram of the electrical circuitry of a first transceiver means, or base transceiver forming part of the apparatus of Figure 1;

Figure 3 is a block circuit diagram of a second transceiver means, or portable transceiver, forming part of the communications apparatus of Figure 1;

Figure 4 is a block circuit diagram of a transmitter incorporated into the transceiver means of each of Figures 2 and 3;

Figure 5 is a block circuit diagram of a receiver incorporated into the transceiver means of each of Figures 2 and 3;

Figure 6 is a detailed circuit diagram of the transmitter of Figure 4;

Figure 7 is a detailed circuit diagram of the receiver of Figure 5; and

Figures 8 to 10 are flow diagrams illustrating particular aspects of the operation of the transceiver means of each Figures 2 and 3.

Referring firstly to Figure 1, a vehicle 10 is shown as having a radio telephone 12 operating in conjunction with first and second transceiver means 14, 16, constructed in accordance with the invention.

The communications apparatus 12 comprises a transceiver 24 coupled by a cord (not shown) to a handset 26 and is generally of conventional construction. More particularly, the transceiver 24 incorporates a radio transmitter and radio receiver and the handset 26 incorporates a microphone and loudspeaker, together with a control apparatus including dialling means, in this instance being of the key pad controlled type. The handset 26 may also include a suitable digital display 28 for display of various information including indication of the state of operation of the handset and indication of numbers being dialled or received.

As is usual, the handset 26 may be used to send voice signals by radio transmission, these voice signals being converted to electrical signals by the aforementioned microphone in the handset and conveyed via the aforementioned lead to the transmitter of transceiver 24 for outward transmission from an antenna 30 on the vehicle. Similarly, incoming radio signals are received by the antenna 30 and directed to the receiver within transceiver 24 for demodulation and direction by the aforementioned cord to the microphone of the handset 26.

In accordance with this embodiment of the invention, the first transceiver means or base transceiver 14 is fitted in the signal path between

the transceiver 24 and the handset 26 and is effective, when appropriately conditioned as later described, to act in the following manner;

a) to inhibit the control of the transceiver 24 under action of the handset 26;

b) to be responsive to incoming radio signals received by the receiver of the transceiver 24 and demodulated thereby, to on-transmit these to the second transmitter means, or hand transceiver 16;

c) to receive, from the transceiver 16, radio signals and to demodulate these and direct them to the transceiver 24 for transmission on the antenna 30.

Referring now to Figure 2, the transceiver 14 is shown as including a microprocessor 36 which controls various operations of the transceiver, including a receiver 38 which receives radio signals incident on an antenna 40 and directed thereto via a duplexer 42. These signals are signals from the transceiver 16. Figure 2 shows a transmitter 44, also controlled by the microprocessor 36, this being effective to transmit radio signals, via an RF amplifier 46 and duplexer 46 to antenna 40 for receipt by the transceiver 16.

The transceiver 14 is adapted to be coupled into the aforementioned line or cord in connecting the handset 26 with the transceiver 24, via two plugs 50, 52, interconnected by suitable leads to a relay control device 54. The latter is also controlled via the microprocessor 36, being interconnected thereto via an interface plug 58.

By suitable manipulation of switches associated with the transceiver 14, the relay control device 54 is controlled to set up the signal conditions indicated in (a), (b), and (c) above. In this condition, then, the plug 50 which couples to the handset 26 is decoupled from connection to the plug 52 which couples to the transceiver 24, so that transceiver 14 is coupled to the transceiver 24 without opportunity for control by the handset 26. Then, transceiver 14 will operate as described, under control of the microprocessor 36 so that incoming communication signals, which may be demodulated audio signals, passed to the plug 52 from the transceiver 24 are passed via the relay control device 54 via a preamplifier 64 to the transmitter 44 for on transmission as radio signals from the antenna 40. On the other hand, received signal passed from the antenna 40 through the receiver 38 is amplified by an amplifier 60, also under control of microprocessor 36, and then passes through the interface plug 58 to the relay control device 54, as demodulated audio signal, through the plug 52 to the receiver of the transceiver 24 for on transmission.

Figure 2 also shows, diagrammatically, a power source 68 for the transceiver 16, this being adapted to couple, for example, to a vehicle car battery. An auxiliary control 70 is also shown, in the form of a relay which, on receipt of suitable signal by the transceiver 14, may operate auxiliary equipment such as a facsimile machine. Also shown is an answering machine plug 74 coupled to the relay control device 54 and which can be, likewise, arranged to receive signal passing in either direction between plug 52 and relay control device 54.

The relay control device 54 can also be operated, by suitable switches, to decouple the remainder of the transceiver 14 from the signal path between the plugs 50 and 52 which plugs are then put into communication to enable normal operation of the vehicle transceiver from the vehicle handset.

Figure 3 shows the transceiver 16 as comprising a further microprocessor 80 and associated key pad 82, for input of instructions, such as for dialling numbers. The microprocessor 80 is powered by a power supply 84 from suitable batteries 86 which may be rechargeable by an inbuilt charger 88 couplable to a suitable domestic AC reticulation system. A liquid crystal display 94 is provided, arranged for driving by an LCD driver 96, also controlled from the microprocessor 80. The LCD 94 is arranged to display information of the kind conventionally displayed on handsets of radio telephones, such as dialled numbers and indications of the status of the operation of the transceiver. A loudspeaker 100 is also provided, connected for operation via an amplifier 102 which receives decoded audio signals from a receiver 104. The receiver 104 is connected to receive radio signals from an antenna 108 via a duplexer 106. A transmitter 110 is also provided, for output transmission of radio signals, this being coupled via an RF amplifier 112 to the duplexer 106 and thus to the antenna 108. A microphone 112 is provided for generating electrical signals corresponding to audio signals received thereby, such signals being amplified by a preamplifier 114 before being directed to the transmitter 110. The microprocessor 80 is also coupled to a volume control circuit 116 which can be

controlled by suitable "up" and "down" switches associated with the transceiver 16 to vary the volume of received signal as broadcast by the loudspeaker 100.

In general operation, the transceiver 16 is effective to receive incoming radio signals, demodulate these and present them for operation of loudspeaker 100, whilst the transmitter 110 is effective to receive signals from the microphone 112 and to use these to modulate suitable radio signals generated by the transmitter.

A block diagram of the transmitter circuit 120 used in both the base transceiver 14 and the remote transceiver 16 is illustrated in Figure 4. Audio frequency signals to be transmitted, including voice signals generated by a microphone and data signals generated by a microprocessor 122, are passed through two audio frequency amplifier stages 124 and 126 to a modulator 128. The audio frequency signals inputted to the modulator 128 modulate a carrier signal. The carrier signal is generated by the modulator 128 with its frequency being determined by a signal generated by and inputted from a phase-locked-loop (PLL) 130 which, in turn, is controlled by the microprocessor 122. The microprocessor 122 selects the frequency of the signal generated by the PLL 130 so that the carrier frequency is within the radio frequency range. The transmitter 120 also includes a phase shift oscillator 138 having its output coupled to the output of the second audio frequency amplifier 126 via a variable resistor 140. The phase shift oscillator 138 is controlled by the microprocessor 122 and is used to shift the phase of the audio

frequency signal outputted by the second amplifier 126 so as to prevent feedback between the loudspeaker 100 and the microphone 112 of the remote transceiver 16. Alternatively, the microprocessor 122 can be used to control the gain of the second amplifier 126 so as to prevent this feedback.

The modulated signal produced by the modulator 128 is passed through first and second buffer stages 142 and 144 to an excitor stage 146. The buffer stages 142 and 144 are used to amplify low level signals generated by the modulator 128. The excitor stage 146 amplifies the signal at the output of the second buffer stage 144 and has its output connected to the input of a driver stage 148. The driver stage 148 is a further amplifier stage having a higher gain than the previous stages 146, 144 and 142. The gain of the driver stage 148 is set by the output of a power control unit 150. The amplified modulated signal produced at the output of the driver stage 148 is passed to an antenna 152 of the transmitter 120 via a final amplifier stage 154 , a low pass filter 156 and a standing wave ratio (SWR) detector 158.

The SWR detector 158 produces an output, which is passed to a power detector unit 160, indicative of the SWR at the output of the transmitter 120. The power detector unit 160 determines if the SWR is too high or too low and sends a signal to the control unit 150 so that the gain of the driver stage 148 is adjusted accordingly. For instance, if the SWR is too high, which is when the antenna 152 and the output of the transmitter 120 are matched, the detector unit 160 causes the control unit 150 to decrease the gain of

the driver stage 148 so as to prevent unnecessary power consumption by the transmitter 120. The microprocessor 122 is also able to control the control unit 150 for reasons which will be described below.

Figure 4 also illustrates a voltage conversion circuit 162 which is used to generate DC voltages for the various units and stages of the transmitter 120 and the receiver illustrated in Figure 5.

The receiver circuit 200, as shown in Figure 5, is employed in both the base transceiver 14 and the remote transceiver 16. Signals received by the antenna 202 of the receiver circuit 200 are passed to a band pass filter 204 which has a broad bandwidth covering a number of channel frequencies which have been allocated to the transceivers 14 and 16 for the purpose of transmission. A radio frequency amplifier 206 amplifies the received signals not filtered out by the band pass filter 204 and passes them to a first mixer 208. The mixer 208 also receives a signal generated by a first local oscillator 210, the frequency of the generated signal being selected in response to the output of a PLL 212 connected to the first local oscillator 210. The PLL 212 is controlled by the microprocesor 122 so as to generate a signal having a particular frequency, which in turn determines the frequency of the signal inputted to the first mixer 208. The frequency is chosen so that the frequencies of the signals inputted to the mixer 208 from the RF amplifier 206 are shifted so that one selected channel has its frequency shifted to the centre frequency, being 10.7 MHz, of a crystal filter 214. The output of the first mixer 208 is passed to

the crystal filter 214 which passes the signal of the selected channel to a demodulator unit 216 and suppresses the signals of the other channels passes by the band pass filter 204.

The demodulator unit 216 includes a second local oscillator, a second mixer, an audio frequency mute detector, an intermediate frequency amplifier and an audio frequency amplifier. The demodulator unit 216 extracts the audio frequency signal transmitted on the selected channel and outputs the audio signal via an audio amplifier 218. The receiver 200 also includes a transistor switch 220 and an LED 222 connected thereto which are used to provided an indication to a user when the receiver 200 has received a transmitted audio signal. A tone decoder 224 is also provided connected to the audio amplifier 218 in order to detect particular tones transmitted which are representative of buttons depressed on the key pad 82 of the remote transceiver 16.

Figures 6 and 7 illustrate circuitry which may be used to configure the transmitter 120 and the receiver 200, respectively. The description above which is relevant to Figures 4 and 5 is also relevant to Figures 6 and 7 respectively, and corresponding reference numerals have been used on the Figures accordingly.

When a call is to be transmitted between the base and remote transceivers 14 and 16 a clear channel needs to be selected for transmission from a number of allocated channels having frequencies in an allocated band. Three methods by which the transceivers 14 and 16 may select a clear channel are described below. One method, illustrated in Figure

8, involves the transmitting transceiver, 14 or 16, determining which channel should be selected. If a call is to be sent, the microprocessor 122 of the transmitting transceiver, 14 or 16, is used to

monitor the strength of signals received on each channel by controlling the PLL 212 so that the crystal filter 214 passes different channels consecutively. When the microprocessor 122 detects one of the channels as being relatively clear from interference, i.e. the level of signals received on that channel is relatively low, data is sent on one predetermined channel to the receiving transceiver 14 or 16. The predetermined channel is chosen as a data channel and the data initially sent contains protocol information for the receiving transceiver 14 or 16. The protocol information includes an indication as to what channel the transmitting transceiver 14 or 16 has selected as being relatively clear. The microprocessor 122 of the receiving transceiver, 14 or 16, then sets its PLL 212 so as to receive only transmissions from the transmitting transceiver 14 or 16 on the selected channel. The receiving transceiver, 14 or 16, also transmits an acknowledgment to the transmitting transceiver, 14 or 16, that the protocol information has been received. Further transmission of data and voice between the two transceivers may then take place on the selected channel. In a normal non-transmission state the transceivers 14 and 16 have their receivers 200 set so as to monitor signals received on the data channel. Although the data channel may not be particularly clear, such interference would not affect recovery of digital data yet it may substantially affect the recovery of analog voice signals.

At any time, information can only be transmitted between the transceiver 14 and 16 if the remote transceiver is switched on. If the base

transceiver 14 is unable to transmit a call to the remote transceiver 16 for any reason, such as clear signal cannot be found or the remote transceiver 16 is out of range, then the base 14 will transmit an appropriate message to the further transceiver 24.

A second method of determining a clear channel for transmission involves the transceivers 14 and 16 monitoring their receivers 200 after they are enabled, as illustrated in Figure 9. Once the transceivers 14 and 16 are enabled their microprocessors 122 are used to scan consecutively through the allocated channels and monitor the output of their respective receivers 200 so as to determine a clear channel. Once a clear channel is found an indication is provided to a user that a clear channel has been found. The remote transceiver 16 performs this indication by using an LCD display. This indication, however, need not be provided by the base transceiver 14. The transceivers 14 and 16 then monitor the selected channel for any incoming signals which indicate that a call is to be transmitted. A transceiver transmitting a call initially transmits protocol information on one channel, if no acknowledgement is received, then it is transmitted on the succeeding channel and so on until an acknowledgement is received from the receiving transceiver indicating that the selected clear channel has been found. If a clear channel cannot be located by the receiving and transmitting transceivers an appropriate indication is provided.

A third method of selecting a channel for transmission involves the transmitting transceiver selecting a clear channel, as described for the first method, and then the data containing the protocol

information is transmitted on any channel. The receivers 200 of the transceivers 14 and 16 are initially set so that the output of the first mixer 208 is sent directly to the demodulator unit 216 without passing through the crystal filter 214. The protocol data is recovered and the microprocessor 122 and sets the receiver 200 of the receiving transceiver, 14 or 16, so as to demodulate signals only of the selected channel. Hence, initially the receiver 200 demodulates signals over a broad bandwidth and then the crystal filter 214 is introduced into the signal path to restrict the bandwidth of signals demodulated.

During transmission the microprocessors 122 of the transceivers 14 and 16 constantly monitor the signal level of the radio frequency signals received and control the control units 150 so as to adjust the gain of the driver stage 148 accordingly. For example, if the signal level of the signals received is found to be high the gain of the driver units 148 is decreased. This optimises the power consumption of the transmitters 120.

Figure 10 illustrates a flow diagram which depicts the operation of the remote transceiver 16 when a user wishes to make a call using the transceiver 16. Initially a telephone number is dialled on the key pad 82, the number displayed on the LCD 94 and then the transceiver 14 selects a channel, as described above for the first and third selection methods. The number is then transmitted using standard dual tone modulator frequencies (DTMF) whereby a signal of two tone frequencies is allocated to a respective button of the key pad 82. The display of the radio telephone 12 is then monitored

to determine any signal transmission difficulties and then finally transmission takes place whilst monitoring and adjusting the radio frequency signal level, as described previously.

All signals transmitted between the transceivers 14 and 16 are encoded based on a predetermined number which is unique to the two transceivers 14 and 16. Preferably this is chosen to be the serial number of the base transceiver 14. The microprocessor 122 then decodes the encoded signals after they are received. This ensures that any one remote transceiver 16 can only communicate with one transceiver 14 and vice versa.

Batteries used in the power supplies of the transceivers 14 and 16 are monitored and a transceiver, 14 or 16, disables its power supply when voltage supplied by its respective batteries becomes relatively low.

Many modifications will be apparent to those skilled in the art without departing from the scope of the present invention as hereinbefore described with reference to the accompanying drawings.

In particular, for instance, the transceivers 14 and 16 may be operated in conjuction with a communication network other than a cellular radio system. This may be achieved in one embodiment by employing an answering machine plug 74 (as shown in Figure 2) which is configured such that it can alternatively be connected into a domestic (or other) telephone point. The transceivers 14 and 16 can then be operated to provide a remote handset facility with one or a variety of communications systems.

CLAIMS

1. A communications apparatus comprising first and second transceiver means (14,16), each for receipt and transmission, by radio transmission, of information signals, such as voice signals, the first transceiver means (14) being provided with coupling means (50, 52, 54) for coupling it to a further transceiver means (24) whereby signals received by the first transceiver means (14) from the second transceiver means (16) are directed to the further transceiver means (24) for transmission by radio transmission therefrom and whereby signals received by the further transceiver means (24) are directed to the first transceiver means (14) for transmission by radio transmission to the second transceiver means (16).

2. A communications apparatus according to Claim 1, wherein said coupling means (50, 52, 54) comprises a relay or switch unit (54).

3. A communications apparatus according to Claim 1, wherein the transceiver of the further transceiver means (24) is connected to a handset (26), which handset (26) includes a microphone, the transceiver (24) being so connected by a flexible line, the coupling means (50, 52, 54) comprising means for coupling the first transceiver (14) into the flexible line.

4. A communications apparatus according to any preceding claim, wherein the second transceiver (16) is provided with an electric power source.

5. A communications apparatus according to Claim 3, wherein the second transceiver means (16) comprises a further handset including a microphone, and the coupling means (50, 52, 54) is switchable between two conditions in a first of which the further transceiver means (24) is controlled by one of the handsets and in a second of which the further transceiver means (24) is controlled by the other of the handsets.

6. A communications apparatus according to any preceding claim, for use in a cellular radio system, wherein the further transceiver means (24) communicates with the system via an assigned cellular frequency channel, the first and second transceiver means (14, 16) providing voice communication via a communication link which is selected by the first and/or the second transceiver means and which is independent of the assigned cellular frequency channel.

7. A communications apparatus according to any preceding claim for use with a communication network, wherein radio communication between said first and second transceiver means (14, 16) is based on a frequency excluded from a frequency range within which the further transceiver (24) establishes radio

communication with said communication network.

8. A communications apparatus according to any preceding claim wherein the first and second transceiver means (14, 16) establish voice communication by means of a preliminary data link, the voice communication and preliminary data link being provided between a common pair of transceivers.

9. A radio telephone for use in association with a vehicle (10), comprising a primary transceiver (24) for communication with a telephone network, and a primary handset (26), said primary transceiver (24) and primary handset (26) being for installation in the vehicle (10), the primary handset (26) being coupled to the primary transceiver (24) for control thereof, and further comprising an additional transceiver (14) for installation in the vehicle (10), and a portable handset having an integral transceiver (16), the portable handset being adapted for radio communication by means of its integral transceiver (16) with the additional transceiver (14) in the vehicle (10), the additional transceiver (14) being coupled to the primary transceiver (24) such that communication with the telephone network via the primary transceiver (24) can occur under the control of either the primary or the portable handset.

10. A radio telephone according to Claim 9 wherein the primary handset (26) is coupled to the primary transceiver (24) by means of a flexible line.

11. A radio telephone according to either of Claims 10 or 11 wherein the additional transceiver (14) in the vehicle (10) is selectively coupled in the signal path between the primary handset (26) and the primary transceiver (24) by coupling means (50, 52, 54) incorporating a switch operable to select that communication with the telephone network via the primary transceiver (24) is controlled by either the primary or the portable handset.

12. A radio telephone according to Claim 11 wherein said communication is exclusively controlled by either the primary or the portable handset.

13. A communications apparatus comprising first and second transceiver means (14,16), each for receipt and transmission, by radio transmission, of information signals, such as voice signals, the first transceiver means (14) being provided with coupling means (50, 52, 54) for coupling it to a further transceiver means (24) whereby signals received by the first transceiver means (14) from the second transceiver means (16) are directed to the further transceiver means (24) for transmission therefrom and whereby signals received by the further transceiver means (24) are directed to the first transceiver means (14) for transmission by radio transmission to the second transceiver means (16).

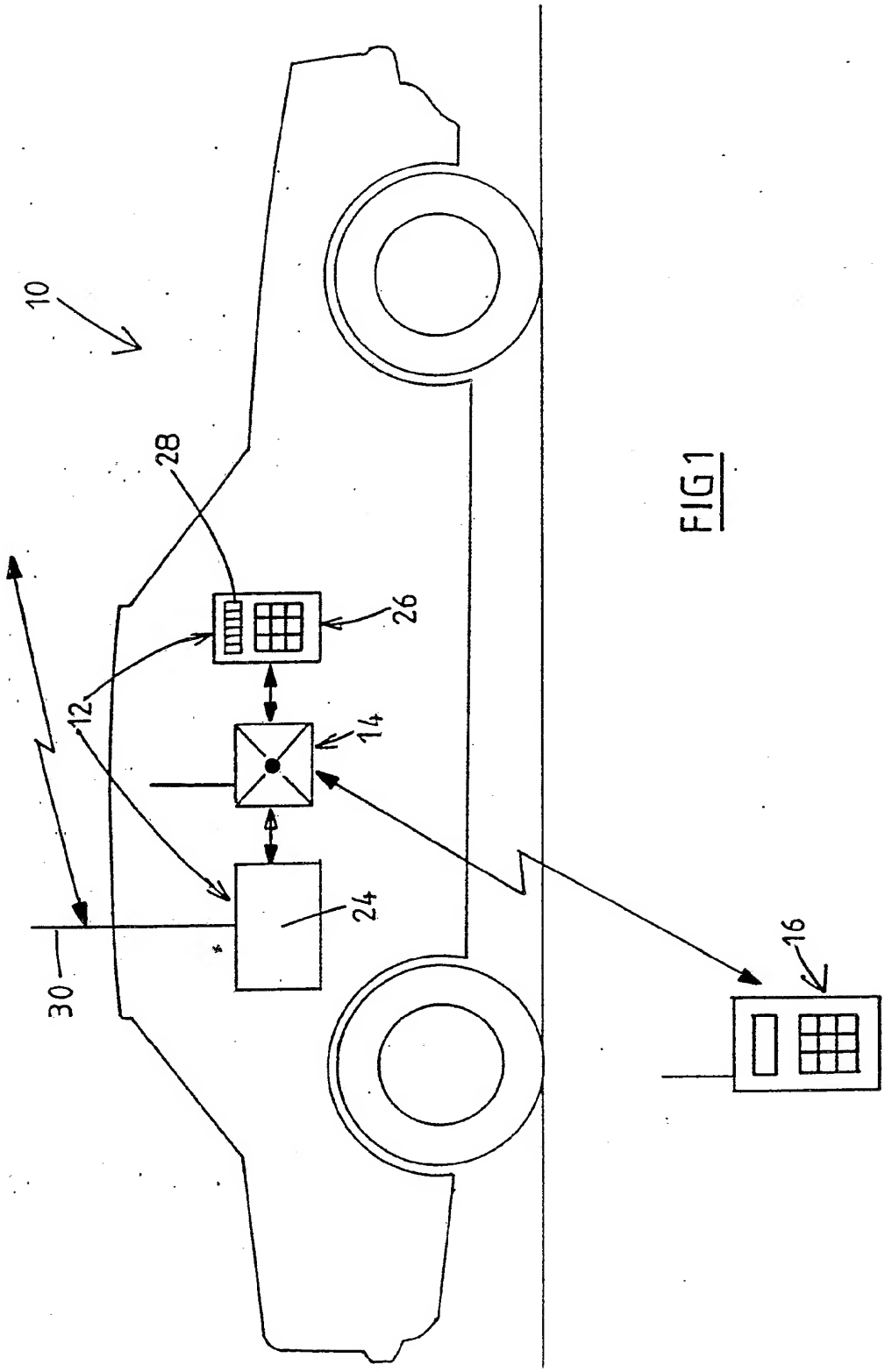


FIG 1

FIG 2

RHS BASE

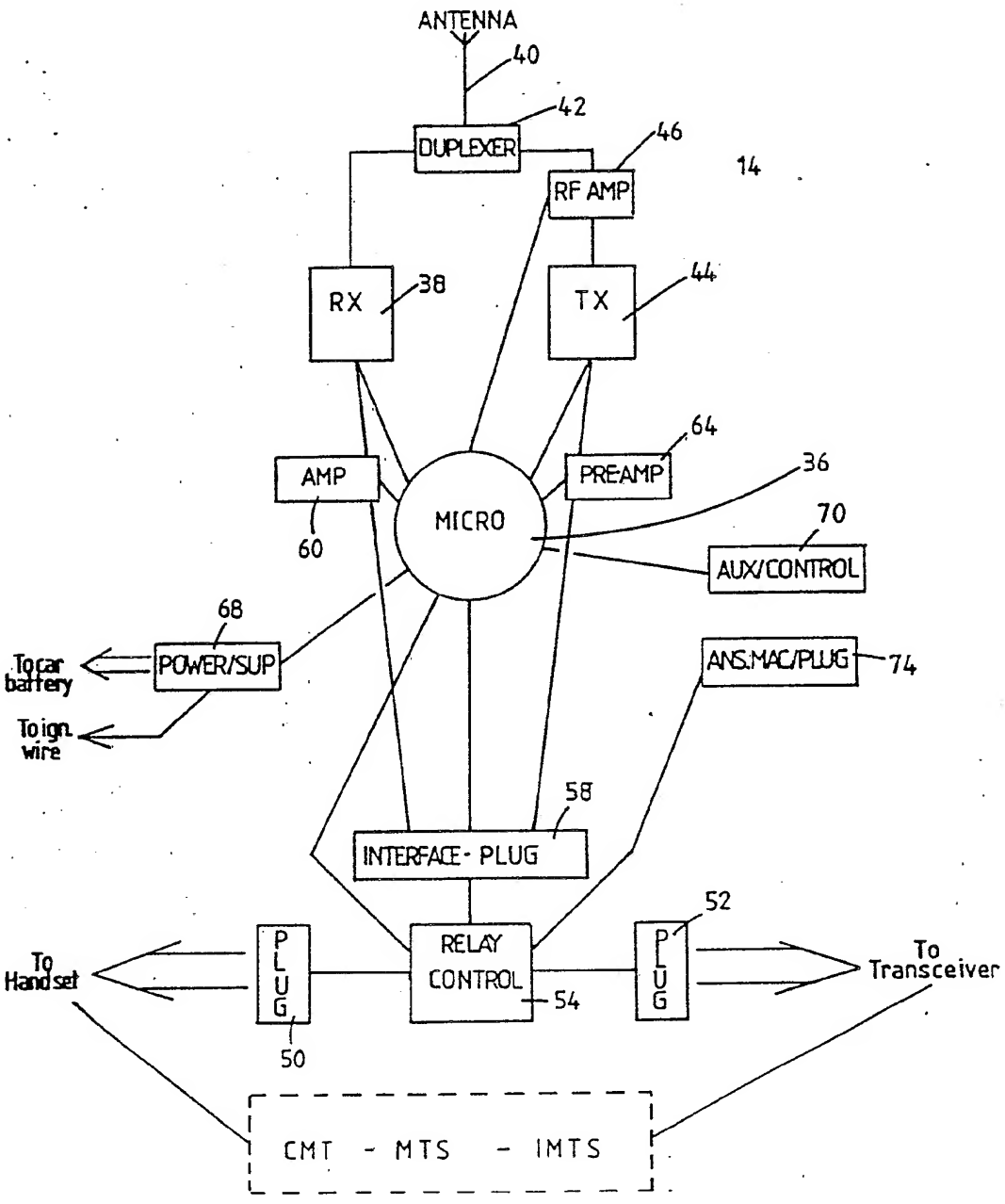
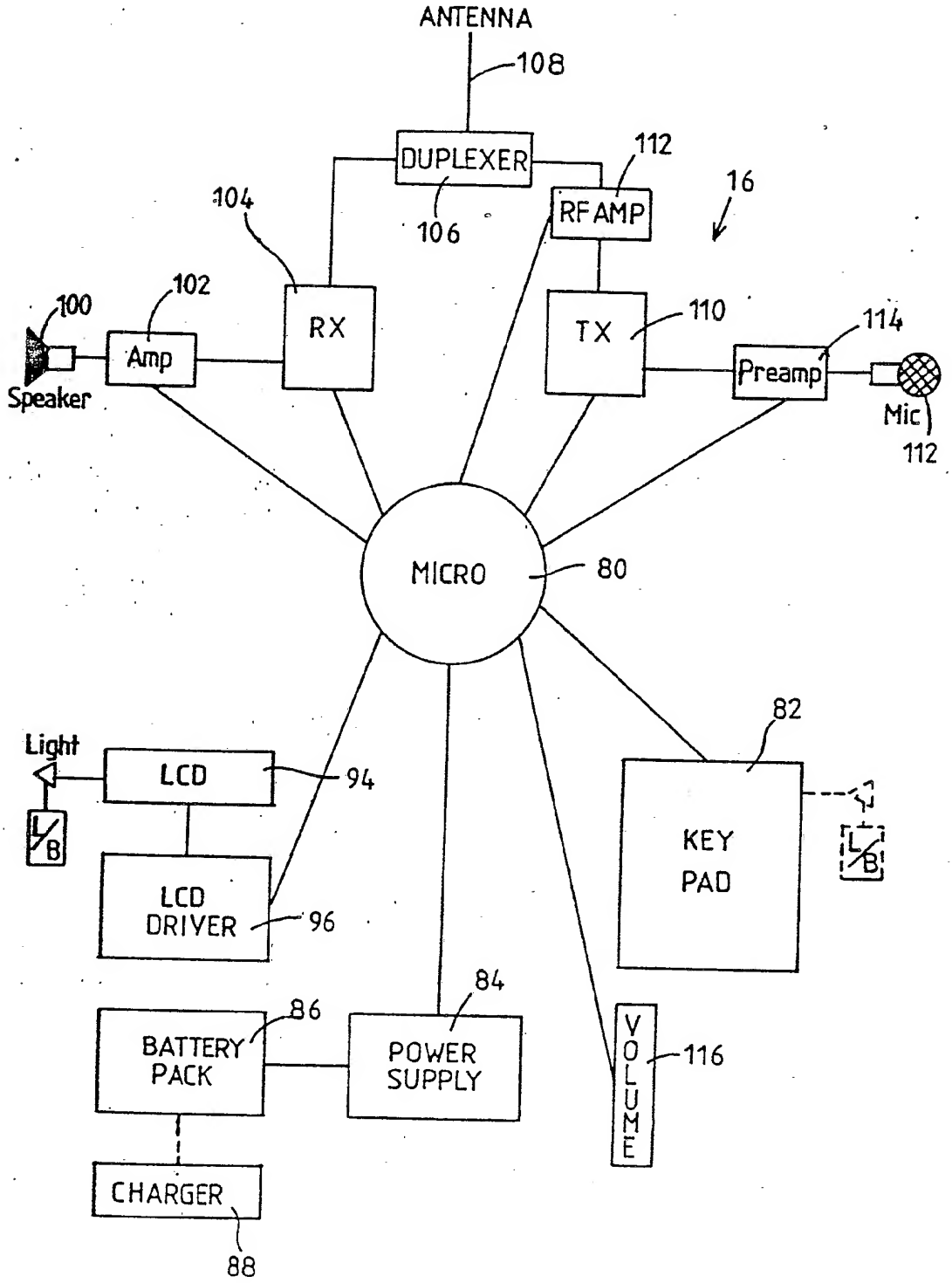


FIG 3

RHS HAND-HELD



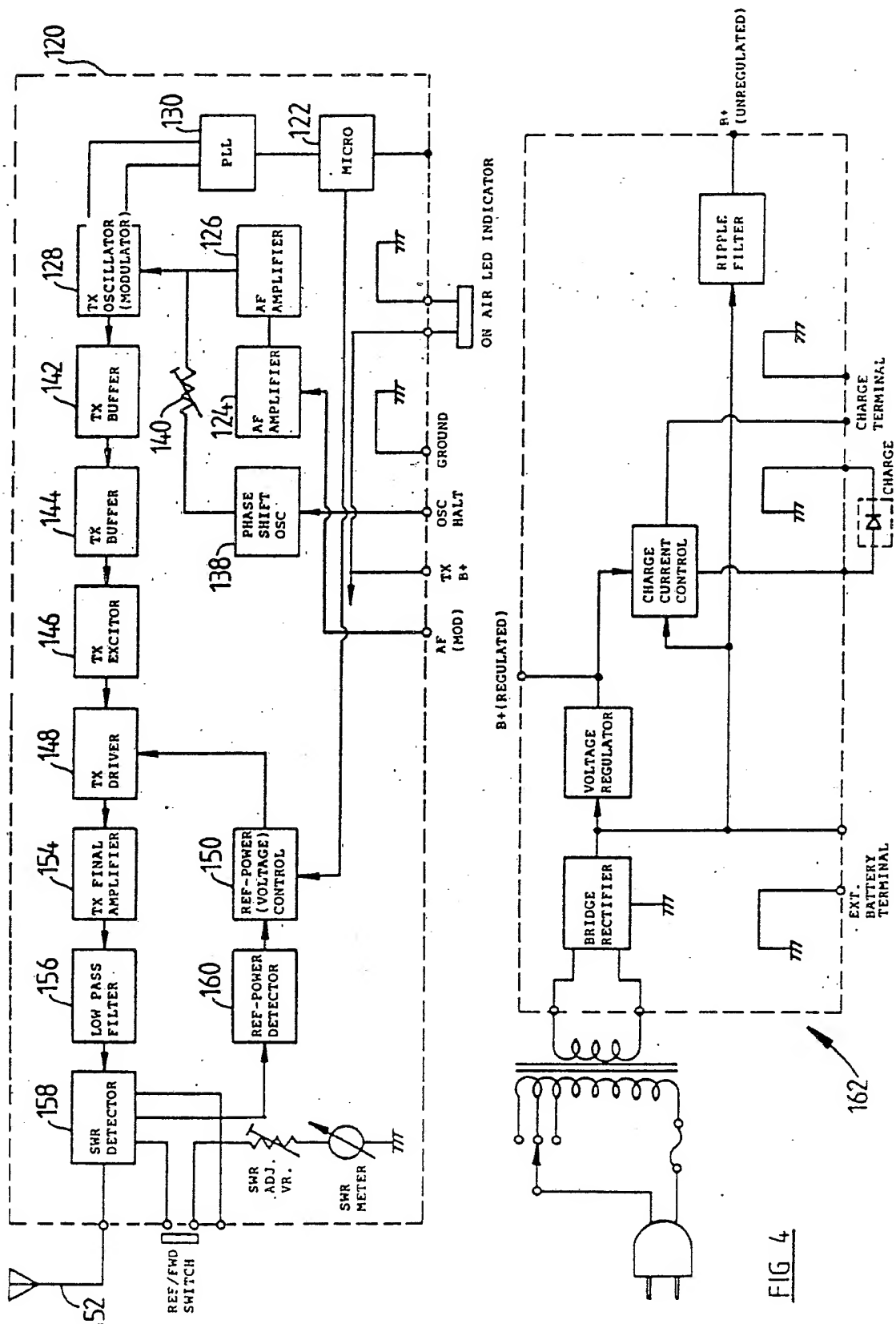

120
130
PLL
122
MICRO
128
TX OSCILLATOR (MODULATOR)
126
AF AMPLIFIER
142
TX BUFFER
140
124
AF AMPLIFIER
144
TX BUFFER
PHASE SHIFT OSC
138
146
TX EXCITOR
148
TX DRIVER
154
TX FINAL AMPLIFIER
150
REF-POWER (VOLTAGE) CONTROL
156
LOW PASS FILTER
160
REF-POWER DETECTOR
158
SWR DETECTOR
SWR ADJ. VR.
SWR METER
REF/FWD SWITCH
152
ON AIR LED INDICATOR
GROUND
OSC HALT
TX B+
AF (MOD)
B+ (UNREGULATED)
RIPPLE FILTER
CHARGE TERMINAL
CHARGE
CHARGE CURRENT CONTROL
B+(REGULATED)
VOLTAGE REGULATOR
BRIDGE RECTIFIER
EXT. BATTERY TERMINAL
162

FIG 4

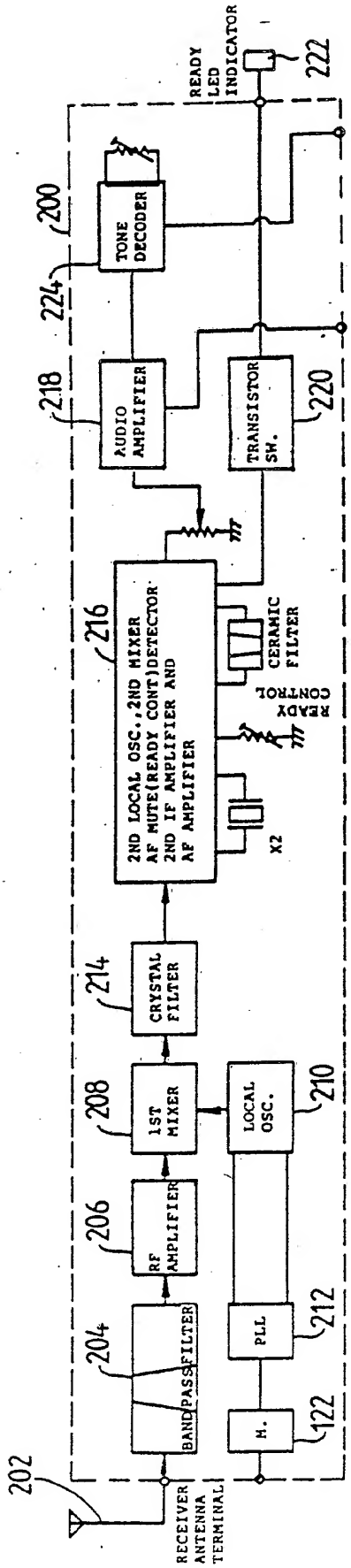

READY LED INDICATOR
222
200
TONE DECODER
224
218
AUDIO AMPLIFIER
TRANSISTOR SW.
220
216
2ND LOCAL OSC.,2ND MIXER
AF MUTE(READY CONT)DETECTOR
2ND IF AMPLIFIER AND
AF AMPLIFIER
CERAMIC FILTER
READY CONTROL
X2
214
CRYSTAL FILTER
208
1ST MIXER
LOCAL OSC.
210
206
RF AMPLIFIER
204
BAND PASS FILTER
PLL
212
M.
122
202
RECEIVER ANTENNA TERMINAL

FIG 5

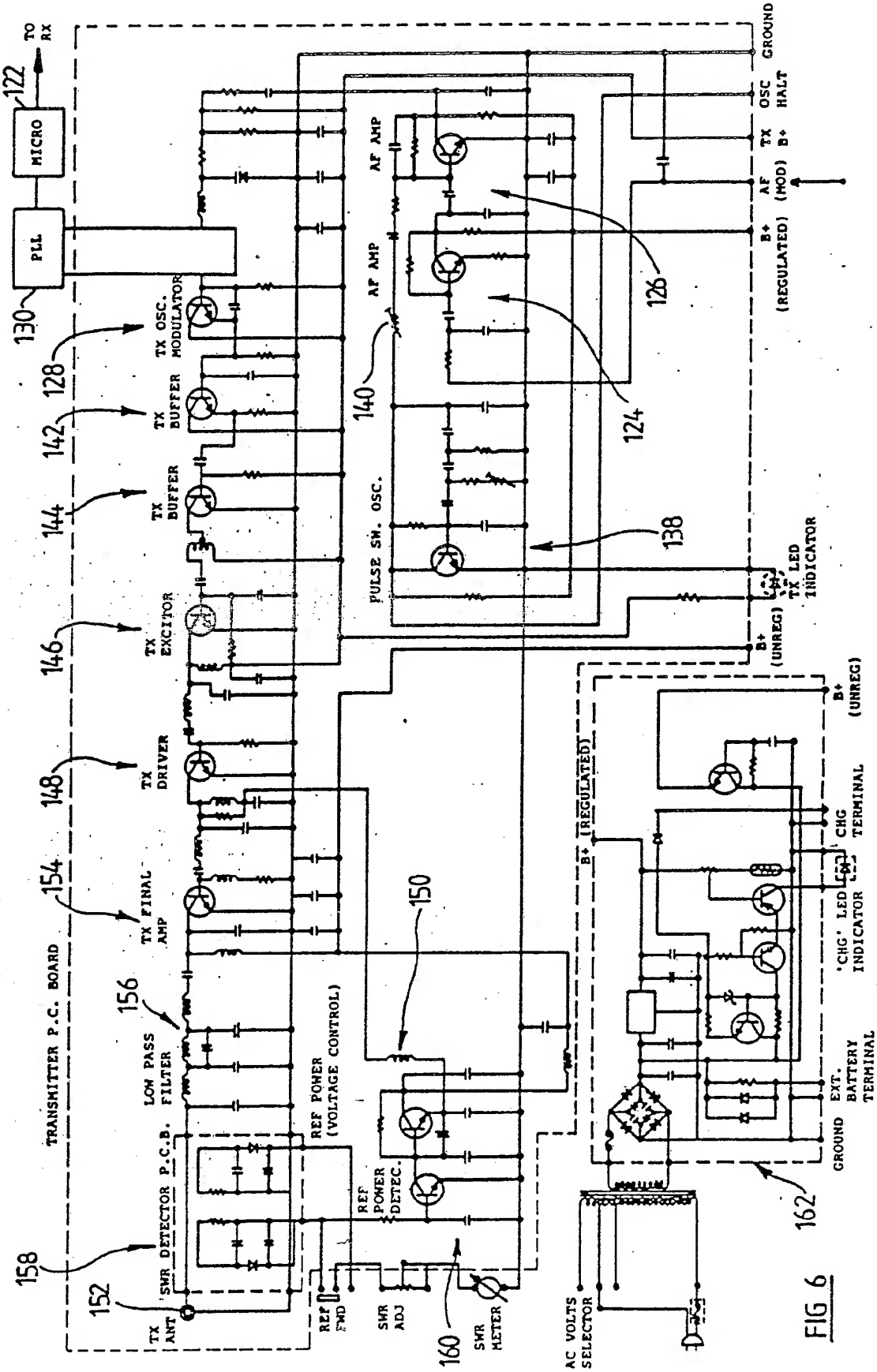

TO RX
122
MICRO
PLL
130
128
TX OSC. MODULATOR
142
TX BUFFER
144
TX BUFFER
146
TX EXCITOR
148
TX DRIVER
154
TX FINAL AMP
156
LOW PASS FILTER
158
SWR DETECTOR P.C.B.
152
TX ANT
TRANSMITTER P.C. BOARD
REF POWER (VOLTAGE CONTROL)
REF POWER DETEC.
150
REF FWD
SWR ADJ
160
SWR METER
AF AMP
AF AMP
140
PULSE SW. OSC.
138
126
124
GROUND
TX OSC HALT
B+ AF (MOD)
B+ (REGULATED)
TX LED INDICATOR
B+ (UNREG)
B+ (REGULATED)
B+ (UNREG)
CHG TERMINAL
'CHG' LED INDICATOR
EXT. BATTERY TERMINAL
GROUND
162
AC VOLTS SELECTOR

FIG 6

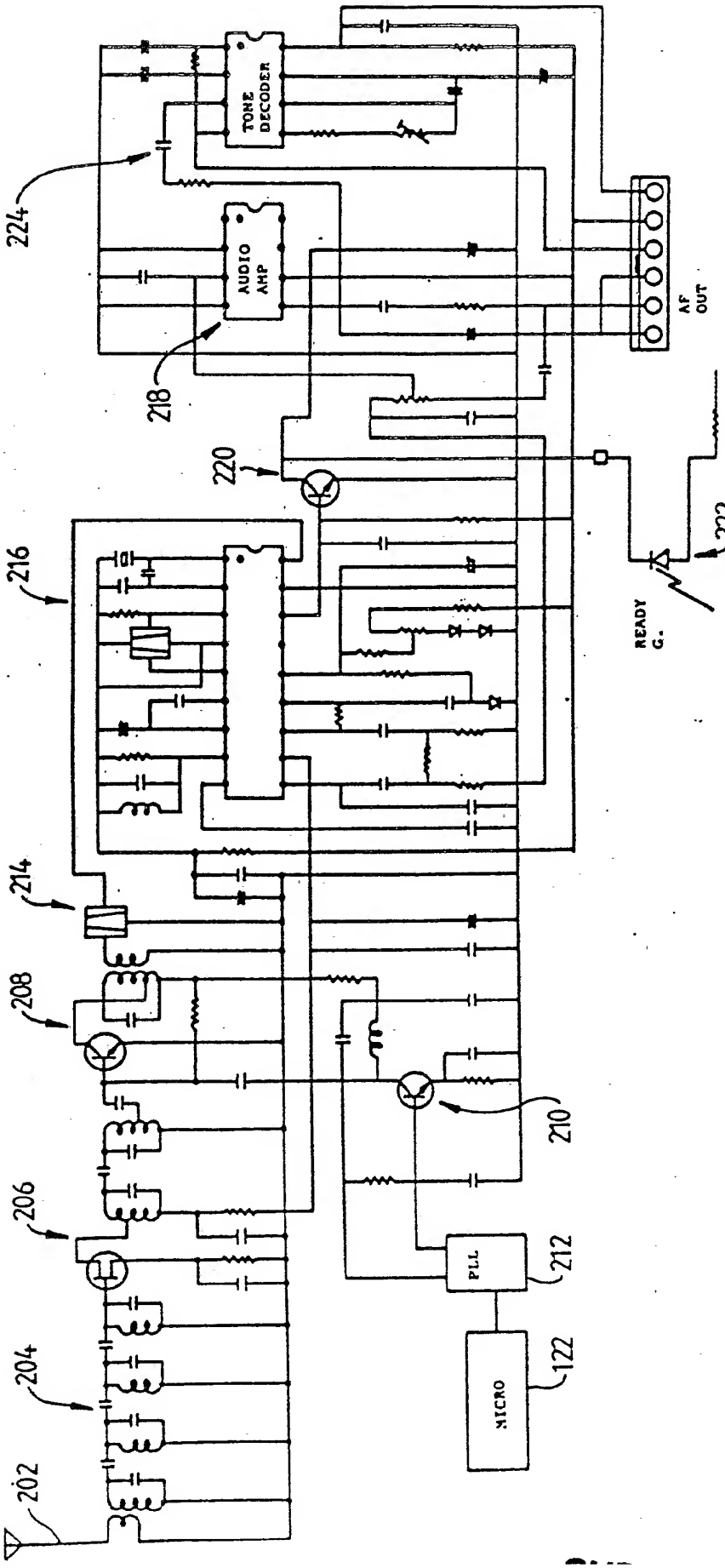

TONE DECODER
AUDIO AMP
AF OUT
READY G.
PLL
MICRO
224
218
220
222
216
214
208
210
206
212
204
122
202

FIG 7

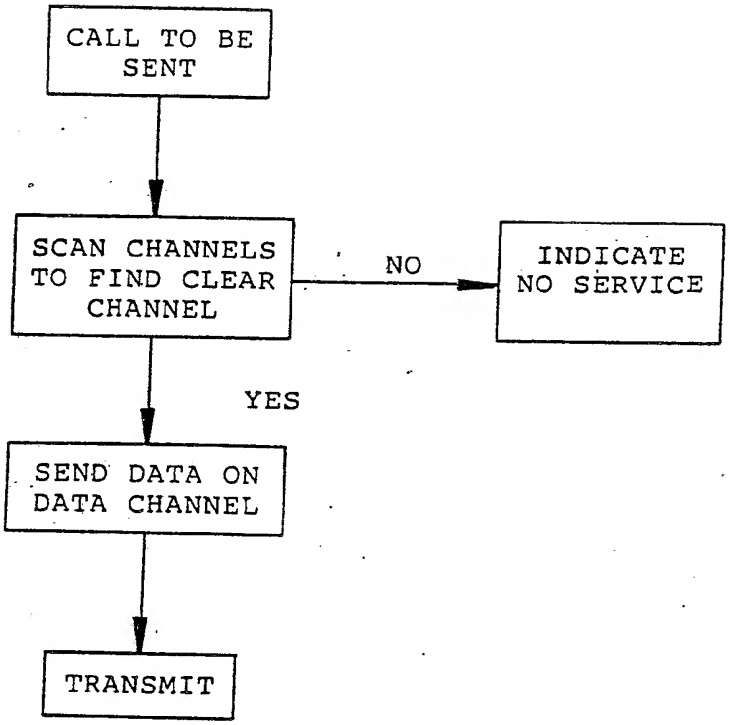

CALL TO BE SENT
SCAN CHANNELS TO FIND CLEAR CHANNEL
NO
INDICATE NO SERVICE
YES
SEND DATA ON DATA CHANNEL
TRANSMIT

FIG 8

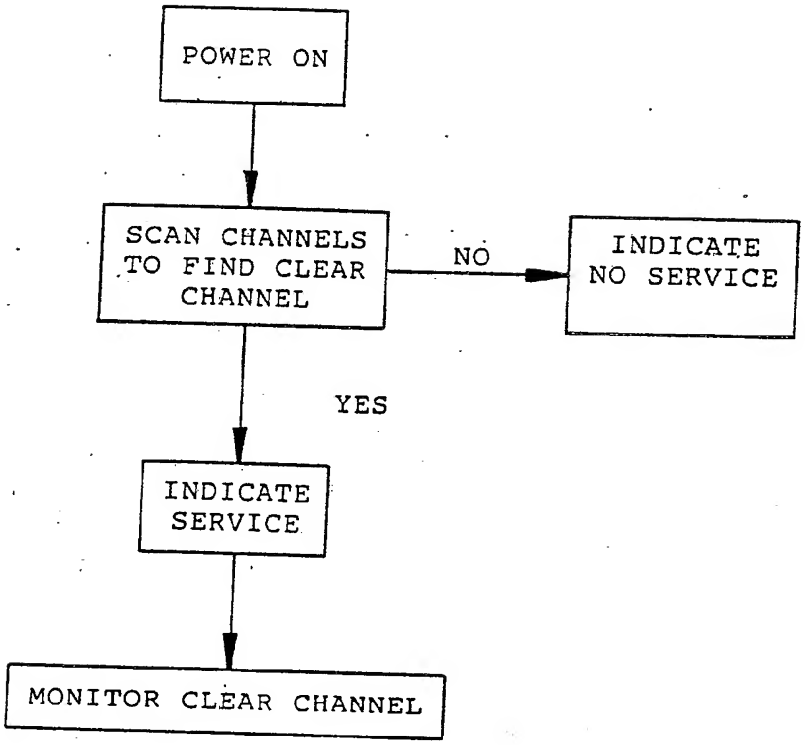

POWER ON
SCAN CHANNELS TO FIND CLEAR CHANNEL
NO
INDICATE NO SERVICE
YES
INDICATE SERVICE
MONITOR CLEAR CHANNEL

FIG 9

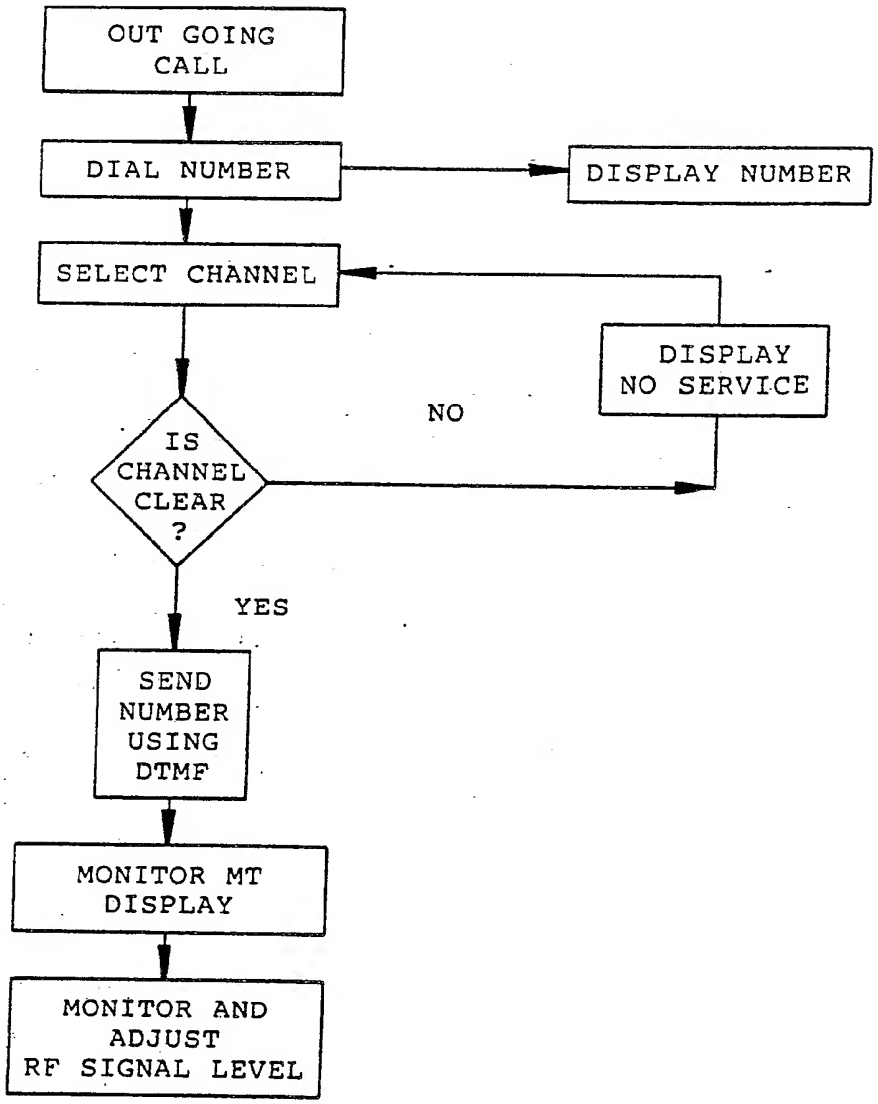

OUT GOING CALL
DIAL NUMBER
DISPLAY NUMBER
SELECT CHANNEL
DISPLAY NO SERVICE
NO
IS CHANNEL CLEAR ?
YES
SEND NUMBER USING DTMF
MONITOR MT DISPLAY
MONITOR AND ADJUST RF SIGNAL LEVEL

FIG 10

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 88/00438

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] H04B 7/26, 7/155, H04M 1/72

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	H04B 7/26, 7/155, H04M 1/72
US Cl.	379/60, 379/61, 455/11, 455/89

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : IPC as above; Australian Classification 05.50

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	AU,B, 23822/77 (502553) (MOTOROLA INC.) 5 October 1978 (05.10.78)	(1,2,4,6,7, 13)
X	DE,A, 3528886 (SIEMENS AG) 19 February 1987 (19.02.87)	(1,2,4,13)
X	US,A, 4659878 (DINKINS) 21 April 1987 (21.04.87)	(1,4,6-8,13)
X	US,A, 4647722 (NISHIDA et al) 3 March 1987 (03.03.87)	(1,2,4,13)
X	US,A, 4627107 (HOHLFELD et al) 2 December 1986 (02.12.86)	(1-4,6,7, 9-13)
X	US,A, 4539706 (MEARS et al) 3 September 1985 (03.09.85)	(1,2,4,6,7, 13)
X	US,A, 3955140 (STEPHENS et al) 4 May 1976 (04.05.76)	(1,2,4,6,7, 13)
X	US,A, 3745462 (TRIMBLE) 10 July 1973 (10.07.73)	(1,2,4,6,7, 13)

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
10 February 1989 (10.02.89)	2 MARCH 1989 (02.03.89)
International Searching Authority	**Signature of Authorized Officer**
Australian Patent Office	R. TOLHURST

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 88/00438

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members		
AU 23822/77	CA 1074871	DE 2715216	FR 2347838
	GB 1525443	JP 52122404	NL 7703748
	US 4056779		
US 4647722	JP 61082541		
US 4627107	AT 9027/78	DE 2805420	FR 2417219
	GB 2014827	IT 1113727	
US 3955140	CH 608634		

END OF ANNEX